RAYTHEON

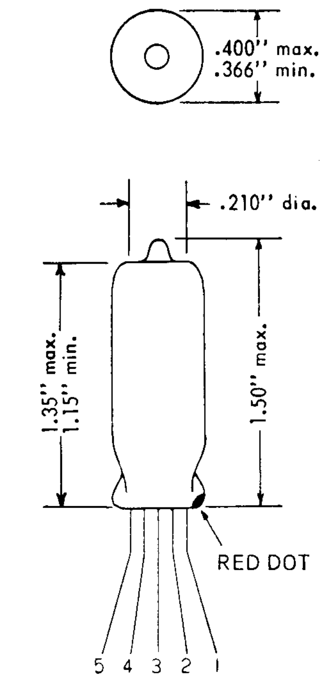
**TECHNICAL INFORMATION**

*Excellence in Electronics*

**RELIABLE SUBMINIATURE TRIODE**

# TYPE CK6152

The CK6152 is a heater-cathode type low-mu triode of subminiature construction capable of operation in the UHF region. This type is characterized by long life and stable performance. It is designed for service where severe conditions of high temperature and mechanical shock or vibration are encountered. The flexible terminal leads may be soldered or welded directly to the terminals of circuit components without the use of sockets. Standard subminiature sockets may be used by cutting the leads to a suitable length.




## MECHANICAL DATA

ENVELOPE: T-3 Glass

BASE: None (0.016" tinned flexible leads. Length: 1.5" min. Spacing: 0.048" center-to-center)

TERMINAL CONNECTIONS: *(Red dot is adjacent to lead 1)*

| | |
|---|---|
| Lead 1 Plate | Lead 4 Heater |
| Lead 2 Cathode | Lead 5 Heater |
| Lead 3 Grid #1 | |

MECHANICAL RATINGS:

| | |
|---|---|
| Maximum Impact Acceleration (Shock Test - Note 3) | 450 G |
| Maximum Uniform Acceleration (Centrifuge Test - Note 4) | 1000 G |
| Maximum Vibrational Acceleration (100 Hour Fatigue Test - Note 5) | 2.5 G |
| Maximum Bulb Temperature | 265 °C |

MOUNTING POSITION: Any

## ELECTRICAL DATA

CAUTION-----To Electronic Equipment Design Engineers: Special attention should be given to the temperature at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if absolute maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are directly related to the degree that regulation of the heater voltage is maintained at its center rated value.

| RATINGS AND NORMAL OPERATION: | MIL-E-1B SYMBOL | ABSOLUTE MINIMUM | NORMAL TEST CONDITIONS (Note 7) | NORMAL OPERATION (Note 6) | ABSOLUTE MAXIMUM | MIL-E-1B UNITS |
|---|---|---|---|---|---|---|
| Heater Voltage (Note 8) | Ef: | 5.7 | 6.3 | 6.3 | 6.9 | V |
| Plate Voltage | Eb: | ---- | 100 | 100 | 180 | Vdc |
| Grid #1 Voltage | Ec1: | -55 | 0 | 0 | 0 | Vdc |
| Plate Dissipation | Pp: | ---- | ---- | 1.0 | 1.1 | W |
| Grid #1 Circuit Resistance | Rg1: | ---- | ---- | 1.0 | ---- | Meg. |
| Heater-Cathode Voltage | Ehk: | -200 | ---- | 100 | +200 | Vdc |
| Cathode Current | Ik: | ---- | ---- | ---- | 22 | mAdc |
| Cathode Resistance | Rk: | ---- | 270 | 270 | ---- | ohms |

### CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)

| TEST | CONDITIONS | AQL % | MIL-E-1B SYMBOL | MIN. | LAL | BOGIE | UAL | MAX. | ALD | MIL-E-1B UNITS |
|---|---|---|---|---|---|---|---|---|---|---|
| **MEASUREMENTS ACCEPTANCE TESTS PART 1** | | **Combined AQL = 1.0% excluding Mechanical and Inoperatives.** | | | | | | | | |
| Heater Current: | | 0.65 | If: | 183 | 190 | 200 | 210 | 217 | 16 | mA |
| Heater-Cathode Leakage: | Ehk = +100 Vdc | 0.65 | Ihk: | ---- | ---- | ---- | ---- | 5 | ---- | μAdc |
| | Ehk = -100 Vdc | | Ihk: | ---- | ---- | ---- | ---- | 5 | ---- | μAdc |
| Grid Current: | | 0.65 | Ic (1): | ---- | ---- | ---- | ---- | -0.3 | ---- | μAdc |
| Plate Current (1): | | 0.65 | Ib (1): | 7 | 8.5 | 10 | 11.5 | 13 | 3.4 | mAdc |
| Plate Current (2): | Ec1 = -13.5 Vdc | 0.65 | Ib (2): | ---- | ---- | ---- | ---- | 100 | ---- | μAdc |
| Transconductance (1): | | 0.65 | Sm (1): | 4200 | 4600 | 5100 | 5600 | 6000 | 900 | μmhos |
| Continuity and Shorts (Inoperatives): | | 0.4 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Mechanical: | Envelope (8-7) (Note 10) | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |

Tentative Data

RAYTHEON

**RELIABLE SUBMINIATURE TRIODE**

## ELECTRICAL DATA (Cont'd)

### CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)(cont'd)

| TEST | CONDITIONS | AQL % | MIL-E-1B SYMBOL | MIN. | LAL | BOGIE | UAL | MAX. | ALD | MIL-E-1B UNITS |
|---|---|---|---|---|---|---|---|---|---|---|
| **MEASUREMENTS ACCEPTANCE TESTS PART 2** | | | | | | | | | | |
| Insulation of Electrodes: | Ef=6.3 V; Eg-all=-100 Vdc; Ep-all=-300 Vdc | 2.5 | Rg1-all: | 100 | ---- | ---- | ---- | ---- | ---- | Meg. |
| | | | Rp-all: | 100 | ---- | ---- | ---- | ---- | ---- | Meg. |
| Transconductance (2): | Ef=5.5 V | 2.5 | $\Delta_{Ef}$ Sm (2): | ---- | ---- | ---- | ---- | 10 | ---- | % |
| Grid Emission: | Eb=100 Vdc; Rg=1.0 meg; Ef=7.5 V; Rk=270 ohms; preheat 5 minutes at Ec1=0; Test at Ec1=-45 Vdc | 2.5 | Ic (2): | ---- | ---- | ---- | ---- | -0.6 | ---- | μAdc |
| AF Noise: | Esig=70 mVac; Ec1=-5.5 Vdc; Rg=0.1 Meg; Rp=0.01 Meg; Rk=0 | 2.5 | EB: | ---- | ---- | ---- | ---- | 17 | ---- | VU |
| Amplification Factor: | | 6.5 | Mu: | 14.5 | 15.5 | 17.5 | 19.5 | 20.5 | 3.5 | ----- |
| Capacitance: | Note 2 | 6.5 | Cgp: | 0.95 | ---- | 1.32 | ---- | 1.7 | ---- | μμf |
| Capacitance: | | | Cin: | 2.1 | ---- | 2.9 | ---- | 3.7 | ---- | μμf |
| Capacitance: | | | Cout: | 0.91 | ---- | 1.28 | ---- | 1.61 | ---- | μμf |
| Low Pressure Voltage Breakdown: | Pressure=55±5 mm Hg; Voltage=300 Vac | 6.5 | ----- | ---- | ---- | ---- | ---- | ---- | ---- | ----- |
| Vibration (2): | F=40 Cps; G=15; Rp=10,000 ohms | 2.5 | Ep: | ---- | ---- | ---- | ---- | 25 | ---- | mVac |
| **DEGRADATION RATE ACCEPTANCE TESTS** | | | | | | | | | | |
| Subminiature Lead Fatigue: | | 2.5 | ----- | 4.0 | ---- | ---- | ---- | ---- | ---- | arcs |
| Shock: | Hammer Angle=30° (Note 3) | 20 | ----- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Fatigue: | 96 Hours; G=2.5; Fixed frequency; F=25 min. 60 max. (Note 5) | 6.5 | ----- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Post Shock and Fatigue Test End Points: | | | | | | | | | | |
| Vibration (2): | F=40 Cps; G=15; Rp=10,000 ohms | ---- | Ep: | ---- | ---- | ---- | ---- | 100 | ---- | mVac |
| Heater-Cathode Leakage: | Ehk=+100 Vdc | ---- | Ihk: | ---- | ---- | ---- | ---- | 20 | ---- | μAdc |
| | Ehk=-100 Vdc | ---- | Ihk: | ---- | ---- | ---- | ---- | 20 | ---- | μAdc |
| Change in Transconductance (1) of individual tubes: | Ef=6.3V | ---- | $\Delta_t$ Sm (1): | ---- | ---- | ---- | ---- | 20 | ---- | % |
| Glass Strain (Thermal Shock): | | 2.5 | ----- | ---- | ---- | ---- | ---- | ---- | ---- | ----- |

| TEST | CONDITIONS | AQL % | MIL-E-1B SYMBOL | MIN. | MAX. | MIL-E-1B UNITS | Max. Defects per characteristic 1st Sample | Combined Sample |
|---|---|---|---|---|---|---|---|---|
| **ACCEPTANCE LIFE TESTS** | | | | | | | | |
| Heater Cycling Life Test: | Ef=7.5V; Eb=Ec1=0V; Ehk=140 Vac; 1 min. on, 1 min. off | ---- | ----- | 2000 | ---- | cycles | --- | --- |
| Heater Cycling Life Test End Points: | | | | | | | | |
| Heater-Cathode Leakage: | Ehk=+100 Vdc | 1.0 | Ihk: | ---- | 20 | μAdc | --- | --- |
| | Ehk=-100 Vdc | | Ihk: | ---- | 20 | μAdc | --- | --- |
| 1 Hour Stability Life Test: | TA=Room; Ehk=+200 Vdc; Rg=1.0 Meg. | ---- | ---- | ---- | ---- | ---- | --- | --- |
| 1Hour Stability Life Test End Points: | | ---- | ----- | ---- | ---- | ---- | --- | --- |
| Change in Transconductance (1) of individual tubes; | (Typical Sample Size=50 tubes) | 1.0 | $\Delta_t$ Sm (1): | ---- | 10 | % | --- | --- |
| 100 Hour Survival Rate Life Test: | TA=Room; Ehk=+200 Vdc; Rg=1.0 Meg. | ---- | ----- | ---- | ---- | ---- | --- | --- |
| 100 Hour Survival Rate Life Test End Points: | (Typical Sample Size=200 tubes) | | ----- | ---- | ---- | ---- | --- | --- |
| Inoperatives: | | 0.65 | ----- | ---- | ---- | ---- | --- | --- |
| Transconductance (1). | | 1.0 | Sm (1): | 3600 | ---- | μmhos | --- | --- |

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**RELIABLE SUBMINIATURE TRIODE**

## ELECTRICAL DATA (Cont'd)

### CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)(cont'd)

| TEST | CONDITIONS | AQL % | MIL-E-1B SYMBOL | MIN. | MAX. | MIL-E-1B UNITS | Max. Defects per characteristic 1st Sample | Combined Sample |
|---|---|---|---|---|---|---|---|---|
| **ACCEPTANCE LIFE TESTS (cont'd)** | | | | | | | | |
| 500 Hour Intermittent High Temperature Life Test: | T Bulb=250°C; Ehk=+200 Vdc; Rg=1.0 Meg. | .... | ..... | .... | .... | ..... | ... | ... |
| 500 Hour Intermittent High Temperature Life Test End Points: | (Typical Sample Size= 20 tubes 1st sample 40 tubes 2nd sample) | .... | ..... | .... | .... | ..... | .... | ... |
| Inoperatives: | | .... | ..... | .... | .... | ..... | 1 | 3 |
| Heater-Current: | | .... | If: | 180 | 220 | mA | 2 | 5 |
| Heater-Cathode | Ehk=+100 Vdc | .... | Ihk: | .... | 10 | μAdc | 2 | 5 |
| Leakage: | Ehk=-100 Vdc | .... | Ihk: | .... | 10 | μAdc | | |
| Grid Current (1): | | .... | Ic (1): | .... | -1.0 | μAdc | 1 | 3 |
| Transconductance (1) change of individual tubes from initial: | | .... | $\Delta_t$Sm(1): | .... | 20 | % | 1 | 3 |
| Transconductance (1) Average Change: | | .... | Ave.$\Delta_t$Sm(1): | .... | 15 | % | ... | ... |
| Insulation of Electrodes: | | | | | | | | |
| g-all | | .... | Rg1-all: | 50 | .... | Meg. | 2 | 5 |
| p-all | | .... | Rp-all: | 50 | .... | Meg. | | |
| Transconductance (2): | | .... | $\Delta_{Ef}$Sm(1): | .... | 15 | % | 2 | 5 |
| Total Defectives | | .... | ..... | .... | .... | ..... | 4 | 8 |
| 1000 Hour High Temperature Information Life Test: | T Bulb=250°C; Ehk=+200 Vdc; Rg=1.0 Meg. | | | | | | | |
| 1000 Hour High Temperature Information Life Test End Points: | Read for same characteristics as for 500 Hour Intermittent High Temperature Life Test. Limits not established. | | | | | | | |

NOTES:

Note 1: Characteristics, Quality Control Test Procedures, and Inspection Levels are made according to the appropriate paragraphs of MIL-E-1B, "Inspection Instructions for Electron Tubes," and MIL-STD-105A.

Note 2: Without shield.

Note 3: Test conditions and acceptance criteria per Shock Test procedures of MIL-E-1B basic specifications.

Note 4: Centrifuge Test with forces applied in any direction.

Note 5: Test conditions and acceptance criteria per Fatigue Test procedures of MIL-E-1B basic specifications.

Note 6: These normal values represent conditions at which control of reliability may be expected.

Note 7: These normal test conditions are used for all characteristic tests unless otherwise stated under the individual test item.

Note 8: For most applications the performance will not be adversely affected by ± 10% heater voltage variation, but when the application can provide a closer control of heater voltage, an improvement in reliability will be realized.

Note 9: Change of transconductance for individual tubes from that value measured at Ef=6.3 V to that value measured at Ef=5.5 V.

Note 10: In addition to meeting the tightened electrical, physical and mechanical tests described in this data sheet these Raytheon Reliable Tubes are now guaranteed to be free from "potential" defects identifiable by microscopic inspection as described by paragraph 5.3.8 of "Inspection Instructions for Electron Tubes."